



5128
**FORT DEVENS
AOCs 44 AND 52**

**FINAL
EXCAVATED SOILS MANAGEMENT PLAN**

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**U.S. ARMY ENVIRONMENTAL CENTER
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FOR AOCs 44 AND 52
FORT DEVENS**

Prepared for:

U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland
Contract DAAA15-91-D-0008

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MAY 1994

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

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1.0 INTRODUCTION

This Excavated Soils Management Plan (ESMP) has been prepared by ABB Environmental Services, Inc. (ABB-ES), under contract to the U.S. Army Environmental Center (USAEC), for use in proposed cleanup activities at the Barnum Road Maintenance Yards (Areas of Contamination [AOCs] 44 and 52). The ESMP is a site-specific plan which is written to ensure that soil excavation, and handling, and final disposition procedures are followed in accordance with pre-approved guidelines.

This ESMP details excavated soil management procedures that are to be used in the Preferred Alternative for remediation of AOCs 44 and 52 soils. The Proposed Plan (ABB-ES, 1994a) provides a brief description of the Preferred Alternative and presents the Army's rationale for its preliminary selection of the Preferred Alternative. The Preferred Alternative consists of multiple components dealing with the control of contaminants from fuel-related releases in unsaturated soils above the groundwater table in the Maintenance Yards. The following components make up the Preferred Alternative: 1) excavate contaminated soils in the Cannibalization Yard associated with releases from the former underground waste oil storage tank; 2) excavate contaminated soils in the Cannibalization Yard associated with the release of fuel from the mogas spill; 3) excavate the top two feet of soil throughout all the Maintenance Yards to remove soil contaminated by crankcase and other automotive releases; 4) place excavated soils in piles at the site for sampling and analysis; 5) cold mix asphalt batch soils which exceed site cleanup levels; 6) backfill excavations with stockpiled soil not found to be contaminated above cleanup levels and with the cold mix asphalt batched material; 7) construct a pavement wearing course over the site; 8) sample groundwater monitoring wells for a period of five years following commencement of remedial activities; and 9) enforce deed restrictions to prohibit removal of the top 2 feet of soil or asphaltic barrier.

The cold mix asphalt batch technology is discussed in detail in the Feasibility Study (FS) Report for AOCs 44 and 52 (ABB-ES, 1994b).

1.1 PURPOSE AND PLAN ORGANIZATION

The purpose of this ESMP is to establish site-specific procedures for excavation, handling and final disposition for soils for excavation activities at AOCs 44 and 52.

This ESMP is presented in four sections. Section 1 provides a brief description of the site and its history. It also discusses the nature of the soil contamination, summarizes

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the site investigation (SI) data and provides an estimate of the volume of soil to be excavated.

Section 2 details the excavation and interim stockpiling procedures to be followed during the removal action. Suggested construction procedures are given in Section 2, although other means and methods may be equally acceptable if submitted for approval by the construction contractor.

Section 3 presents a detailed plan of the post-excavation sampling and analysis to be performed on AOCs 44 and 52 soils.

Section 4 presents the plan for final disposition of the soils excavated at AOCs 44 and 52 in accordance with contaminant concentration as determined by the post-excavation sampling and analysis.

1.2 INSTALLATION AND SITE DESCRIPTION

Fort Devens was placed on the National Priorities List under CERCLA as amended by the Superfund Amendments and Reauthorization Act (SARA) in December 1989. In addition, under Public Law 101-510, the Defense Base Realignment and Closure Act of 1990 (BRAC), Fort Devens was selected for cessation of operations and closure. In accordance with these acts, numerous studies, including a Master Environmental Plan, Enhanced Preliminary Assessment, and SIs have been conducted which address potential areas of contamination referred to as Study Areas (SAs) at Fort Devens. A current total of 59 SAs have been identified and placed in 13 priority groups defined in the Federal Facility Agreement between the Army and U.S. Environmental Protection Agency (USEPA).

Beginning in 1991, SIs were conducted in SA Groups 3, 5, and 6. The Cannibalization Yard (SA 44) and Table of Distribution and Allowances (TDA) Maintenance Yard (SA 52) were two SAs in SA Group 3 which were investigated and designated as AOCs due to the presence of contamination in the soils. As directed by the USAEC, ABB-ES conducted a FS for the unsaturated soils in AOCs 44 and 52 to develop and analyze potential remedial alternatives to lead to a Record of Decision (ROD). The FS Report (ABB-ES, 1994b) presents a detailed analysis of seven remedial alternatives from which the Proposed Plan (ABB-ES, 1994a) selects the Preferred Alternative as well as provides the Army's rationale for its preliminary selection of the remedial alternative.

AOCs 44 and 52 are located northeast of Building 3713, on Barnum Road, on the Main Post (Figure 1-1). The total area of these two SAs is approximately 8.8 acres. The areas are fenced and are actively used for vehicle storage. AOC 44 is known as the Cannibalization Yard. It is a separately fenced, unpaved area where vehicles are stored before being dismantled for usable parts. Historically, it has been reported that 55 gallon drums of waste oil were also stored in the yard. AOC 52 was originally comprised of only the TDA Maintenance Yard. Because the adjacent Regional Training Site (RTS) Yard and K-Yard (Figure 1-1) have also had a long and continuing history of vehicle storage, these two yards have been included with AOCs 44 and 52 (all yards combined as one site) at the direction of the Army. The TDA Maintenance Yard, RTS Yard and K-Yard are separately fenced, unpaved vehicle storage and maintenance yards where vehicles with maintenance needs are stored while awaiting repairs. Vehicles with oil leaks are now kept in a Spill Containment Basin area which was constructed in 1991 within the TDA Maintenance Yard (Figure 1-1). The TDA Maintenance Yard, RTS Yard, K-Yard and Cannibalization Yard will be collectively referred to in this ESMP as the Maintenance Yards.

Under BRAC, Fort Devens is required to close by July 1997. Although it is anticipated that main operations at the base will cease by the fall of 1995, the Maintenance Yards are expected to remain operational until the summer of 1996.

1.3 NATURE OF CONTAMINATION

Gasoline, motor oil and other automotive fluids were likely released during vehicle dismantling operations in the Cannibalization Yard. Individual releases are not likely to have been of any significant volume, but numerous releases during the period in which the yard has been used account for the soil contamination problem identified to be largely within the surface soils of the site. Two individual releases (hereinafter referred to as the Hot Spot Areas) which have been reported and identified during the SI and underground storage tank (UST) removal activity are discussed below.

Approximately 20 gallons of "mogas" (motor vehicle gasoline) and hydraulic fluid were reportedly released near the center of the Cannibalization Yard in 1985 during the cannibalization process. Visibly contaminated soil was immediately excavated and containerized by Army personnel (Army, 1985). Soil samples taken from boring 44B-92-06X during ABB-ES' SA Groups 3, 5 and 6 SI (ABB-ES, 1993) reveal total petroleum hydrocarbon compound (TPHC) concentrations ranging from 8,520 parts per million (ppm) to 1,560 ppm from ground surface to 12 feet below grade respectively and are

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believed to be associated with the spill area. At the time of the incident, the spill area reportedly measured approximately 20 by 20 feet (Army, 1985).

A 1,000-gallon UST formerly used to store waste oil in the Cannibalization Yard was removed in May 1992. Visibly contaminated soil was stockpiled, and laboratory analysis of soil samples from the bottom and one side of the tank excavation showed TPHC concentrations of 17,600 ppm and 9,780 ppm, respectively (ATEC, 1992). Laboratory analysis was also conducted on a waste oil sludge sample obtained from inside the tank for hazardous waste manifest characterization purposes. Results revealed the following levels of semivolatile organic compounds (SVOCs) and Toxicity Characteristic Leaching Procedure (TCLP) metals: 110 ppm naphthalene, 128 ppm bis(2-ethylhexyl)phthalate (B2EHP), 240 ppm 2-methylnaphthalene, 0.04 ppm cadmium, 0.4 ppm lead, 0.05 ppm nickel and 3.07 ppm zinc. Analytical results did not reveal the presence of volatile organic compounds (VOCs) or polychlorinated biphenyls (PCBs). Reportedly, the tank was observed to be in good condition with no holes or severe corrosion. However, inspection revealed that the fill pipe was improperly connected to the bung of the tank, allowing the pipe contents to leak at the connection (ATEC, 1992). Later in July 1992, contaminated soils surrounding the removed tank were excavated. Reportedly, the over excavation measured approximately 15 feet by 22 feet by 12 feet deep (ATEC, 1992a). Laboratory tests on samples collected by the contractor from two sidewalls and stockpile revealed residual TPHC concentrations ranging from 1,110 to 2,740 ppm following the over excavation.

1.4 SUMMARY OF SI FINDINGS AND SUPPLEMENTAL FIELD INVESTIGATIONS

ABB-ES has compiled an SI Report (ABB-ES, 1993) which details the nature and extent of contamination in soils at AOCs 44 and 52 as defined by a series of field investigations conducted during the 1992 to 1993 period. Additionally, the FS report (ABB-ES, 1994b) details supplemental field investigations which were conducted in June 1993 in response to specific data gaps identified during the FS process. Supplemental investigations included additional soil and groundwater sampling in the vicinity of the hot spot areas and investigating the influence of bituminous pavement on soil analysis for polynuclear aromatic hydrocarbon (PAH) contaminants.

1.4.1 Site Soils

The SI for AOCs 44 and 52 focused on sampling soil across the site for analysis of a variety of organic and inorganic analytes and for TPHC. Sampling and analytical results

from 16 soil borings (Figure 1-2) detailed in the SI Report (ABB-ES, 1993) indicated that organic compounds, specifically PAHs and TPHC, were the principal contaminants of concern.

Tables 1-1 and 1-2 present the laboratory results for organic compounds from 16 soil borings.

Motor oil is a potential source of the organic analytes detected. The following general observations with regard to organic contamination are drawn from the SI soil data:

- Aromatic VOCs were detected in three out of a total of 48 soil samples. One of the three samples was from boring 44B-92-06X, which is believed to be associated with the 1985 mogas spill.
- There appears to be no obvious lateral or vertical distribution pattern of VOCs in soil.
- SVOCs, predominantly PAHs, were detected in 34 of 48 samples throughout the AOCs. SVOC concentrations are typically higher in surface samples and are generally absent or of lower concentration with depth. Investigations performed during a Supplemental (SSI) tend to support the assessment that elevated cPAH concentrations found in at least three of the SI soil samples could be due to the presence of broken pieces of bituminous pavement in the soil. Details of this investigation are discussed in the FS Report.
- TPHC appears to mimic the distribution of SVOCs. This is consistent with the presumed release mechanisms discussed previously. TPHC was detected in 38 of 48 samples. One boring, 44B-92-06X, which may be associated with the mogas spill, revealed TPHC concentrations at 8520 ppm, 7680 ppm and 1560 ppm at 0-2, 5-7 and 10-12 foot levels respectively. The average TPHC concentration from the other 35 samples across the site was 172 ppm.
- No lateral distribution pattern for SVOCs or TPHC is evident.

Sampling and analytical results for the inorganic compounds detected in AOCs 44 and 52 soils are detailed in the SI Report. None of the inorganic contaminants are at levels that present significant human health or ecological risk or require remedial action (ABB-ES, 1994b).

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Test pits, excavated for construction of a concrete spill-containment basin (Figure 1-1) in the southeast corner of the Maintenance Yard revealed zones of contaminated soil below the surface (Mullen, 1991; Lincoln Environmental, 1992). TPHC was found at 420 to 700 ppm concentrations in surface soil samples and at 80 ppm in one sample from a 4-foot depth. TPHC was not detected in the 8-foot-deep soil samples.

1.4.2 Hot Spot Areas (Mogas Spill and UST Areas) Soils

Defining the vertical and horizontal extent of contamination around the former tank and spill areas was required to better assess the remedial alternatives evaluated in the FS. Although soil removal actions have taken place around the excavated tank, the extent (specifically depth) of contamination remaining was not readily defined due to the lack of conclusive analytical data at the time of the soil over-excavation. Horizontal and vertical extent of contamination from the mogas spill was unknown except perhaps in the vicinity of existing boring 44B-92-06X. This boring may have been located only at the periphery of the spill or not in the spill area at all. An Army Pollution Incident Report was discovered which located the mogas spill closer to the center of the Cannibalization Yard (Army, 1985).

ABB-ES conducted a SSI that entailed drilling four additional borings, 44B-93-07X, -08X, -09X and -10X, in the Cannibalization Yard in the vicinity of the excavated underground tank area and mogas spill area (Figure 1-3) and then sampling soil from these borings to better define the extent of contamination. Soil analyses was conducted for inorganics (only lead in 44B-93-09X and -10X) SVOCs, TPHC, and PCBs generally at four depth intervals (5, 10, 15 and 25 feet below ground surface [bgs]). Table 1-3 presents the laboratory results for organic compounds from the four SSI soil borings.

TPHC was detected in only two of 16 samples; 121 ppm in boring 44B-93-08X at 10 feet bgs and 38.1 ppm in boring 44B-93-09X at 5 feet bgs. Boring 44B-93-08X is located near the southeast end of the excavated UST. The TPHC detected at the 10 foot level generally corresponds with the location of the tank bottom and is likely due to residual contamination from the excavated UST. Boring 44B-93-09X is located in the Cannibalization Yard approximately 25 feet north of the area where the mogas spill was suspected of occurring. The duplicate of this sample revealed a concentration below the detection level (29.6 ppm). It is not conclusive if this detected concentration is a result of the mogas spill. The only SVOC compounds detected were B2EHP at 1.4 ppm in 44B-93-09X at the 25 foot depth and trace concentrations of fluoranthene, phenanthrene and pyrene (0.25, 0.09, and 0.12 ppm respectively) in 44B-93-09X at the 5 foot depth.

The duplicate of the 5 foot depth sample revealed concentrations below detection level for these PAHs.

Inorganic analytes were detected in the mogas spill and waste oil storage tank area soils at concentrations which are the same order of magnitude above background as detected on an AOCs 44 and 52 site-wide basis.

1.4.3 Bituminous Pavement Analysis

The apparent randomness in detecting PAH compounds in the Maintenance Yard soils during the SI raised questions about the potential source of these contaminants. Based on visual observations, broken-up bituminous paving is present in various areas of the Maintenance Yard surface soils. However, there appear to be no historical records indicating when and in what areas the pavement was applied. Aerial photographs taken over many years do not show any evidence of paving. Additionally, soils which were stockpiled during the construction of the spill containment basin (with TPHC concentrations ranging between 10 to 250 ppm) were suspected to be an asphalt treated, gravel road base (Lincoln Environmental, 1992). Bituminous paving contains PAH compounds and it is believed that the presence of paving or asphalt treated road base material in the maintenance yard soils may impact the soil analytical results.

To investigate the potential influence of bituminous pavement on soil analysis for PAH contaminants, samples of non-oil stained bituminous pavement and visibly oil-stained soil were obtained from the Maintenance Yards and analyzed for chromatographable organic compounds, including target PAHs contaminants of concern to establish a general fingerprint of contaminants potentially associated with paving. Contaminant concentrations present in the paving were compared with those present in the visibly stained soil sample and with the contaminants detected in the SI surface soils containing elevated PAHs. As detailed in the FS Report (ABB-ES, 1994b), it is evident that the analyte distribution for the pavement is very similar to that found in each of the SI elevated PAH soil samples. There is much less of a correlation between the oil-stained soil and SI soil sample analyte distribution. This would tend to support the assessment that the elevated PAH concentrations found in at least three of the SI soil samples could be due to the presence of broken pavement in the soil.

Excavating predesign test pits is recommended to better predict the soil characteristics (color, texture, and presence of pavement) and layers containing cPAHs thus enabling optimization of soil excavation and handling activities during remedial action at AOCs 44 and 52.

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1.5 ESTIMATED VOLUME OF EXCAVATED SOILS

The quantity of soil requiring excavation at AOCs 44 and 52 is derived based upon the human health risk estimates and cleanup concentration levels established in the FS Report for AOCs 44 and 52 (ABB-ES, 1994b). PAH cleanup concentrations are risk-based while TPHC cleanup concentrations are established using the new Massachusetts Contingency Plan (MCP) as a guideline which became effective October 1, 1993. The following sections summarize the evaluations performed to arrive at the volume of soil estimated to be excavated for final soil disposition. The plan for final soil disposition is detailed in Section 4.

1.5.1 cPAH Risk-Based Cleanup Levels

In the FS Report (ABB-ES, 1994b), human health risk estimates were generated for soil contamination associated with crankcase releases and the mogas spill at AOCs 44 & 52. As detailed in the FS, risk estimates made under a construction worker exposure scenario (for the mogas spill and crankcase releases) at AOC 44 fell within acceptable limits for both carcinogens and noncarcinogens. However, risk estimates made for a long-term worker/top 2 feet of soil exposure scenario exceeded the acceptable limits for carcinogens. The estimated risk associated with the top 2 feet of soil at the site is caused predominantly by elevated cPAH concentrations detected in approximately 4 of the 16 surface samples analyzed. The FS Report contains a target level equation and parameters, target level spreadsheets and target level summary for several methods investigated for establishing cleanup levels to achieve a cancer risk that is within the USEPA Superfund target risk range. The computed target levels ranged from 37 ppm down to 0.06 ppm for the methods investigated. During a meeting with the regulatory agencies a cleanup level of 7 ppm average total cPAHs was selected for the FS from the target risk range (ABB-ES, 1994b).

1.5.2 TPHC Cleanup Levels

TPHC cleanup levels for AOC 44 and 52 soils are established using the MCP as guidance. This guidance establishes 500 ppm as the cleanup criteria for TPHC using MCP Method 1 and S-1 Soil and GW-1 groundwater categories. Further assessment of this cleanup criteria is detailed in the FS Report (ABB-ES, 1994b). Use of the TPHC soil standard under the Method 1, S-1 soil and GW-1 groundwater categories results in the most health-protective of the Method 1 standards. This is because S-1 soil is, by

definition, the most accessible and therefore presents the greatest potential for exposure, and GW-1 groundwater is assumed to be potable.

1.5.3 Waste Volume/Distribution

As discussed in Section 1.5.1, the target clean-up level established for AOCs 44 and 52 soils for the FS is an average of 7 ppm total cPAHs. Based on the SI sampling results, 11 of 16 surface samples exceed this level. (The 11 exceedances also include those samples with cPAH concentrations below detection levels but with assumed concentrations equal to one-half the detection level, totaling in excess of 7 ppm). However, because the cPAHs occur randomly and potentially across the entire yard, the entire area of AOCs 44 and 52 to a 2 foot depth will be excavated, stockpiled for sampling and analysis, and characterized for re-use/treatment/disposal to meet the objective of being protective to human health. This amounts to a total unexcavated soil volume of 28,440 cubic yards (cy) or 38,400 tons (assuming a bulk density of 1.35 tons/cy).

As discussed in Section 1.5.2, the target clean-up level established for AOCs 44 and 52 soils for TPHC is 500 ppm. Based on the SI sampling results, the average TPHC concentrations across the site at the 0 to 2 foot, 5 to 7 foot and 10 to 12 foot ranges are 315 ppm, 52 ppm and 33 ppm respectively. Maximum concentrations are 1210 ppm, 170 ppm and 119 ppm respectively. These values exclude the TPHC concentrations at boring 44B-92-06X (that may be associated with the mogas spill) and TPHC concentrations associated with the waste oil UST. Excluding these two areas, TPHC concentrations from the SI that exceed the 500 ppm target level are found only in the top 2 foot sampling level. Only 4 of 16 surface samples exceed the 500 ppm level. However, due to the random distribution of cPAHs and TPHC, the entire area of AOCs 44 and 52 to a 2 foot depth will be excavated for TPHC as well as cPAH contamination.

Based on the results of the SI and the SSI, it is assumed that a total unexcavated soil volume of 700 cy in the hot spot areas exceeds the 500 ppm clean-up level for TPHC and will require excavation. This is based on a worst case assumption that boring 44B-92-06X is located on the southern edge of a spill unrelated to the mogas spill (an assumed 300 cy of soil exceeding 500 ppm) located in the north corner of the Cannibalization Yard and that boring 44B-93-10X is located off the northern edge of the mogas spill requiring excavation of an equal soil volume. It also assumes that approximately 100 cy of soil in the UST area will require excavation.

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Excavation of the hot spot areas will entail sampling radially southeast to southwest of boring 44B-93-10X to define the location where there was believed to be a mogas spill (centrally in the Cannibalization Yard). Based on the Army Incident Report (Army, 1985) clean-up of this spill was immediate which may have prevented contamination of soils at greater depth. Another possibility is that the mogas spill actually occurred in the vicinity of 44B-92-06X. Remediation and confirmation sampling will also be performed in the tank excavation area and in the vicinity of boring 44B-92-06X.

2.0 EXCAVATION AND INTERIM SOIL DISPOSITION PLAN

The first step of remediation of AOCs 44 and 52 soils requires excavation and interim disposition (stockpiling on-site) of soil. Briefly the plan for this step entails the following elements:

- Excavating predesign test pits to better predict the soil characteristics (color, texture, and presence of pavement) and layers containing cPAHs thus enabling optimization of soil excavation and handling activities during remedial action at AOCs 44 and 52; and obtaining soil gradation data for asphalt batching design.
- Following specified excavation and stockpiling sequence/criteria during excavation activities.

The following sections detail these excavation and interim soil disposition plan elements which are to be followed for the remediation of AOCs 44 and 52 soils. Details regarding pre-excavation activities such as requirements for a health and safety plan, quality control plan, work plan (including dewatering/runoff control procedures and dust control requirements), baseline air monitoring and site preparation (including fence work and excavation layout) will be included in the design.

2.1 PREDESIGN cPAH/GRAIN SIZE DISTRIBUTION TEST

As detailed in the FS Report, the finding of high concentrations of target cPAHs in asphalt fragments may have significance on soil handling techniques used for remediation of AOCs 44 and 52 soils. For example, it would be of primary importance in segregating and stockpiling soils if cPAH contaminated soil is found primarily associated with the top 6-inch lift (or pavement zone). Additionally, test pitting and sampling for cPAHs within the top two feet will aid in estimating the quantity of soil which will require asphalt batching. Gradation data will assist in designing the asphalt batch mix for the design of the parking lot.

Procedures for conducting the cPAH/Grain Size Distribution Test are detailed below:

- Select nine representative areas (with and without evidence of paving on or near the surface). Excavate test pits to a depth of 2 feet. Record stratigraphy. Note color and texture of soil.

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- Sample each test pit in 6-inch increments and field screen for cPAHs by gas chromatograph/flame ionization detector (GC/FID) Modified EPA Method 8100 and total recoverable petroleum hydrocarbons by Non-dispersive Infrared (NDIR) Modified Method 418.1. Screen samples with a No. 20 sieve prior to analysis to remove asphalt pieces. Samples from each 6 inch increment will be a composite of one subsample from each side of the test pit.
- Select three representative test pits to conduct a grain size distribution analysis for each 6-inch lift in accordance with ASTM D 422. This information will be used to determine the appropriateness of the soil for asphalt batching and what additives may be required.

2.2 EXCAVATION AND INTERIM STOCKPILING ACTIVITIES

All intrusive construction activities will be conducted in accordance with the contractor's approved plans developed expressly for environmental conditions expected at the site. Excavation, segregation and interim stockpiling operations will be monitored by an environmental professional (EP). The EP will be knowledgeable in monitoring and detecting soil contamination and will have had the appropriate health and safety training as required by the Occupational Safety and Health Administration and as described in the Health and Safety Plan.

Excavation and interim stockpiling activities consist generally of the following elements:

- Air monitoring
- Excavating hot spot areas and surface soils across the site
- Segregating and interim stockpiling of soils for sampling; and backfilling

Excavation activities will be performed in a preplanned sequence as detailed below. Air monitoring, soil segregation and stockpiling will follow criteria specified in subsequent paragraphs.

2.2.1 Excavation Sequence

1. Commence excavating soil containing pavement fragments in the surface soils (anticipated to be within the top two 6 inch layers). Soil will be excavated in 6-inch layers down to a 2 foot depth, and stockpiled and sampled in 100-cy batches. It is believed that layers with pavement contain the highest concentration of cPAHs, therefore this soil will be excavated first and stockpiled separately. Follow soil segregation criteria detailed in Section 2.2.3 and sampling protocol in Section 3.1.
2. Perform trench exploration to include or exclude the 44B-93-10X area as the potential mogas spill area. To initially identify the potential hot spot area, excavate trenches in the north-south and east-west direction over 44B-93-10X to approximately 3 feet deep (below original grade). Trench lengths will be 40 feet to the west, south and east of 44B-93-10X and 10 feet north. Perform headspace screening by a photoionization detector (PID) or NDIR screening on sidewalls every 10 feet. Location and number of samples may be adjusted in the field, depending upon screening results, to better define the area. This area will be excluded from further investigation and excavation if there is no detection of volatiles or TPHC over 500 ppm.
3. Commence excavating the hot spot area around 44B-92-06X. To initially define the extent of the hot spot area, excavate trenches in the north-south and east-west direction over 44B-92-06X to approximately 5 feet deep (below original grade). Trench lengths will be as directed by the EP. Perform headspace and NDIR screening on sidewalls and/or bottom of trench if staining is not evident. Follow soil segregation criteria detailed in Section 2.2.3 and sampling protocol in Section 3.1. Commence full excavation to the dimensions determined by the trench screening and as directed by the EP. If appropriate, decontaminate equipment and move to next hot spot area while waiting for NDIR results. Upon receipt of TPHC analysis greater than 500 ppm, continue excavating and sampling to the dimensions specified by the on-site EP and resample. Upon receipt of TPHC analysis of less than 500 ppm, backfill the excavation.
4. Commence excavating hot spot area around 44-93-10X (only if sampling in item #2 reveals soils with concentrations exceeding cleanup levels.) Initial excavation dimensions to be determined upon the analysis of the data from item #2. Follow procedures specified in item #3.

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5. Commence excavating the hot spot area around the UST. This area has been previously over-excavated to the dimensions shown in Figure 1-3. Excavate the soil in this over-excavated area. Stockpile soil and collect five soil subsamples to yield one composite sample every 100 cy to ensure clean backfill and native soil are clearly distinguished. Upon reaching native soil as determined by the EP, follow procedures in item #3 regarding continued excavation, stockpiling, sampling and backfilling.
6. Any other "hot spot areas" observed during the excavation of the surface soils will be excavated, segregated, stockpiled and sampled in a similar manner as described in the ESMP for hot spot area soils.
7. Install utilities (storm drains and catch basins). Backfill the surface soil area with stockpiled soil that is below site cleanup levels and aggregate subbase material (if required by the design). Apply the asphalt batched material, and bituminous wearing course. Backfilling may be done concurrently with item #1 through 4 above providing there is no interference with the hot spot excavations. Excavation sequence of surface soils and installation of utilities will be detailed in the design and/or Contractors work plan. The Army anticipates removing all vehicles from the Maintenance Yards prior to commencement of construction.

2.2.2 Excavation Air Monitoring Criteria

Prior to commencement of site activities, a baseline air monitoring program will be completed to assess airborne contamination prior to any removal action. Monitoring will be conducted for the evaluation of levels of total suspended particulate (TSP), VOCs, and PAHs. Results of the baseline air monitoring and SI data will be used in the selection of target compounds for further air monitoring during the excavation activities. During excavation activities, excavation air monitoring will be performed using portable instrumentation and will consist of one confirmation evaluation and daily perimeter monitoring. Details of the air monitoring plan will be provided in the design.

- Confirmation Evaluation. To confirm action levels and cPAH/total suspended particulate (TSP) ratio established during the baseline air monitoring program, one series of three monitoring events will be conducted at the onset of excavation, during a period of intensive activities. Using the same program and procedures performed for the baseline monitoring, sampling will be conducted for TSP, VOCs and cPAHs at

upwind and downwind locations on three separate days. The results of this confirming testing will be used to adjust the target compounds, action limits, and/or TSP/cPAH ratio (as necessary) for the continued perimeter monitoring during the remainder of the excavation period.

- **Daily Perimeter Monitoring.** During the excavation and mechanical screening activities, air monitoring will be conducted on a daily basis to evaluate VOCs and TSP (as a surrogate for PAHs). Monitoring will be conducted around the site perimeter using portable instrumentation.

2.2.3 Soil Segregation Criteria

Hot Spot Area Soils. Initial screening will be made for visible and olfactory evidence of TPHC contaminated soils as a means of targeting soils requiring investigation using headspace or NDIR screening techniques. If possible, soils will be segregated in separate piles (maximum 100 cy) according to jar headspace readings, NDIR results, or visual segregation scheme:

- Headspace = nondetect; no visible staining; NDIR < 500 ppm
- 150 vol/vol > Headspace > nondetect; staining, odor;
500 ppm < = NDIR < 60,000 ppm (asphalt batching permit limits)
- Headspace > 150 vol/vol; heavily laden; NDIR > 60,000 ppm avg.

Jar headspace analysis will be performed by collecting samples in 8-ounce, wide mouth, glass containers, filled two-thirds full. The mouth of each container will be covered with aluminum foil and capped with a Teflon-lined lid. Samples will be allowed to stabilize at a temperature of at least 20 degrees Celsius for at least 45 minutes. After that time, the container lid will be removed, and the foil pierced with the PID probe. The PID will be calibrated prior to each day's use.

The NDIR field screening for TPHC will be performed using a portable NDIR analyzer (Horiba OCMA 220 or equivalent). The regular instrument analysis procedure (for water) shall be altered to approximate EPA Test Method 418.1 to obtain TPHC values. If measured values exceed the scale of the instrument, the sample may require dilution and/or instrument adjustment.

SECTION 2

Site Soils (0 to 2 foot depth). An initial screening will be made for visible and olfactory evidence of waste material or overtly contaminated soils. Soils observed to contain broken pieces of pavement will be segregated as cPAH-contaminated soil in maximum 100 cy piles, and kept in separate piles for analytical screening. Soils with fuel odor or that visibly show evidence of petroleum contamination will also be separated from soil with no visible evidence of contamination. All soil to a 2-foot depth will be excavated, stockpiled and sampled (see Section 3.0) regardless of physical evidence of contamination.

2.2.4 Stockpiling Criteria

Soils excavated from hot spot areas will be placed on, and covered with a minimum 8-mil polyethylene tarp to prevent mixing of TPHC contaminated soils with clean soils. Surface soils will also be placed on polyethylene tarps if there is potential for soil to contaminate clean soil. All stockpiling of soils will be restricted to the areas at AOCs 44 and 52 to be detailed in the design. Contractor's excavation work sequence in relation to stockpiling methods should be detailed in his/her work plan. Stockpiling and analytical work will be done concurrently to minimize the duration that soils are left on-site. Jersey barriers or concrete blocks may be used to separate piles if required.

3.0 SAMPLING AND ANALYSIS PLAN

This section provides an overview of the sampling and analysis plan proposed for the excavation activities at AOCs 44 and 52. Table 3-1 summarizes the sampling and analysis to be performed. Incidental sampling and analytical details (e.g., decontamination water sampling and analysis, field/laboratory quality control [QC], data logging and reporting) will be detailed in the final remedial design.

Sampling and analysis will be performed within hot spot excavations (during and upon completion of excavation activities), and on soil stockpiles derived from hot spot and surface soil (top two feet) excavations.

Confirmation sampling of soil below the top 2 feet of soil at AOCs 44 and 52 is not proposed. Based on the quantitative risk evaluation in the FS Report (ABB-ES, 1994b), risks associated with the subsurface soils (below 2 feet) are within acceptable limits for both carcinogens and noncarcinogens; and no sampling or excavating of subsurface soils is required. However, excavation and stockpile sampling of the surface soils will be performed in layers such that there will be a record of contaminant concentration with depth within the top two feet.

Confirmation sampling is also not proposed for the sidewalls of the surface soil excavation but will be performed only in the unlikely event that there is evidence of a spill or release that extends outside the fence perimeter. Based on aerial photographs, site area and traffic patterns around AOCs 44 and 52 have remained principally the same as current conditions for approximately 30 years. As a result, the perimeter of the site has been historically defined by the fence perimeter.

3.1 SAMPLING AND ANALYSIS OF HOT SPOT EXCAVATIONS

The sampling and analysis plan for the hot spot excavations will consist of the following tasks:

- Collect samples from sidewalls and bottom of each excavation as excavation progresses and analyze for TPHC by NDIR or VOCs by PID.
- When NDIR results (and PID readings) indicate that contaminant concentrations in excavated soils are below cleanup levels, ten (10) grab samples will be collected from the bottom and sides of the excavation and

SECTION 3

sent to an off-site laboratory for analysis to document that cleanup levels are achieved.

In general, samples will be obtained from the backhoe bucket or from extendable hand tools. The samples will be collected from two locations on the bottom and 2 locations along each sidewall of each excavation or in areas where NDIR results reveal highest TPHC concentrations. Areas of the exposed soil that are visibly stained or have a petroleum-like odor will be preferentially sampled over the ten locations specified above. The intent is to sample soil on a "worst case" basis such that any contamination, if present, will be sampled and identified.

3.2 SAMPLING AND ANALYSIS OF STOCKPILED SOILS

The sampling and analysis plan to classify stockpiled soils from hot spot excavations as acceptable for reuse at the site without treatment, will consist of the following tasks:

- Collect five soil subsamples and field composite to yield one sample for every 100 cy of stockpiled soil or for every segregated stockpile.
- Analyze samples in the field laboratory for TPHC using the Modified Method 418.1 (NDIR).

The sampling and analysis plan to classify stockpiled soils from the surface soil excavation as acceptable for reuse at the site without treatment, will consist of the following tasks:

- Collect five soil subsamples and field composite to yield one sample for every 100 cy of stockpiled soil or for every segregated stockpile whichever smaller in volume.
- Analyze all composited samples for TPHC using the Modified Method 418.1 (NDIR) and for the seven carcinogenic PAHs listed in Table 3-1 using Modified Method 8270 (GC/MS) by a field laboratory.

In general, subsamples for composite samples will be taken from a 12- to 24-inch depth within the excavated soil stockpile. Subsamples will be collected in a pattern that provides reasonably uniform coverage of the stockpile and of soil presenting the highest contamination (based on visual characteristics, odor, or field screening).

As detailed in Sections 1.4.3 and 2.1, the elevated cPAH concentrations found in some of the SI samples could be due to the presence of paving fragments in soil. Test pitting the top 2 feet may provide additional information regarding where in the surface soil horizon the cPAHs may exist and the association with pavement layers, if any. Analytical samples will be screened through a No. 20 sieve to remove pavement particles down to the size of coarse sand prior to performing the analysis.

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4.0 FINAL SOIL DISPOSITION PLAN

Final disposition of soils will be dependent upon analytical results of stockpiled AOCs 44 and 52 soil.

AOCs 44 and 52 soil will be classified as "clean" if it meets the cleanup criteria of 500 ppm for TPHC and the risk-based cleanup criteria of 7 ppm (average) for cPAHs. This soil will be used to refill a portion of the excavated areas at AOCs 44 and 52. Upon receipt of analytical results, the soil will preferably be immediately backfilled into designated areas or, if backfill areas are not available, will be stored in designated piles separate from other soil for later use as on-site backfill.

Soil that exceeds the cleanup criteria of 500 ppm TPHC and 7 ppm (average) cPAHs will be asphalt batched on-site. Upon receipt of analytical results, the soil will preferably be immediately prepared for asphalt batching (screened, crushed and/or mixed with aggregate, if required, to obtain the appropriate pavement design). The asphalt batched material will then be spread and rolled to the thickness and contours to be detailed in the final design. The Army will place a bituminous wearing course over the batched material to ensure the integrity of the asphalt batched material as a parking lot base for current and future property use and for improved property value.

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

| | |
|--------|---|
| ABB-ES | ABB Environmental Services, Inc. |
| AOC | Area of Contamination |
| B2EHP | bis(2-ethylhexyl)phthalate |
| bgs | below ground surface |
| BRAC | Base Realignment and Closure Act of 1990 |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| cPAH | carcinogenic polynuclear aromatic hydrocarbon |
| cy | cubic yard |
| EP | environmental professional |
| ESMP | Excavated Soils Management Plan |
| FS | Feasibility Study |
| GC/FID | gas chromatograph/flame ionization detector |
| GC/MS | gas chromatograph/mass spectrometry |
| MCP | Massachusetts Contingency Plan |
| NDIR | Non-dispersive Infrared |
| PAH | polynuclear aromatic hydrocarbon |
| PCB | polychlorinated biphenyl |
| PID | Photoionization Detector |
| ppm | parts per million |
| ROD | Record of Decision |
| RTS | Regional Training Site |
| SA | Study Area |
| SARA | Superfund Amendments and Reauthorization Act |
| SI | site investigation |
| SSI | supplemental site investigation |
| SVOC | semivolatile organic compound |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TDA | Table of Distribution and Allowances |

ABB Environmental Services, Inc.

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

| | |
|-----------------|---|
| TPHC | total petroleum hydrocarbon compound |
| TSP | total suspended particulate |
| $\mu\text{g/g}$ | micrograms per gram |
| USAEC | United States Army Environmental Center |
| USEPA | United States Environmental Protection Agency |
| UST | underground storage tank |
| VOC | volatile organic compound |

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- U.S. Department of the Army (Army) 1985. File notes by R. Spelfogel regarding Inspection of Cannibalization Point - TDA Maintenance Yard, Ft. Devens, Mass.; May 1, 1985.

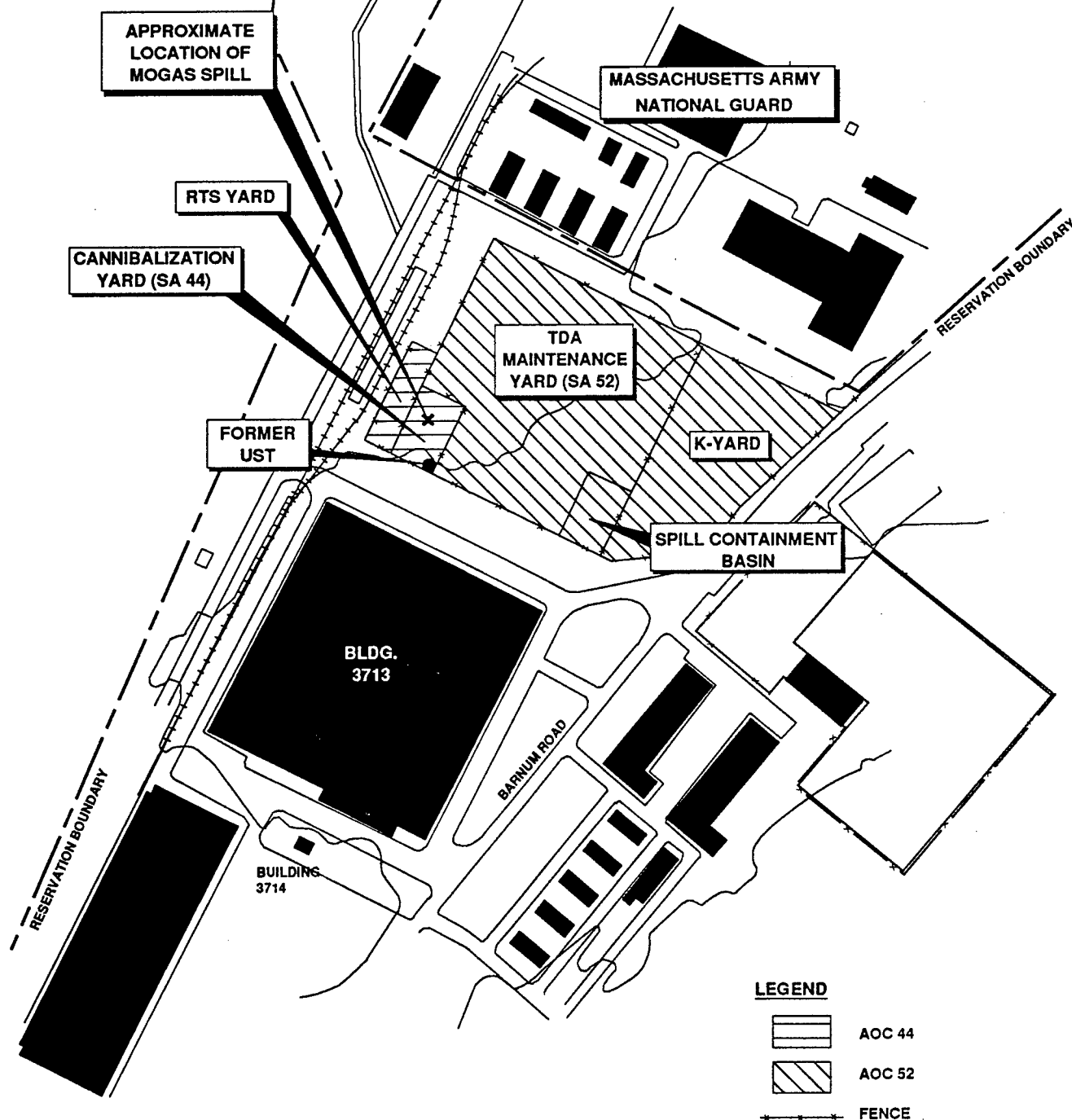


FIGURE 1-1
LOCATIONS OF AOCs 44 & 52
FORT DEVENS, MA

ABB Environmental Services, Inc.

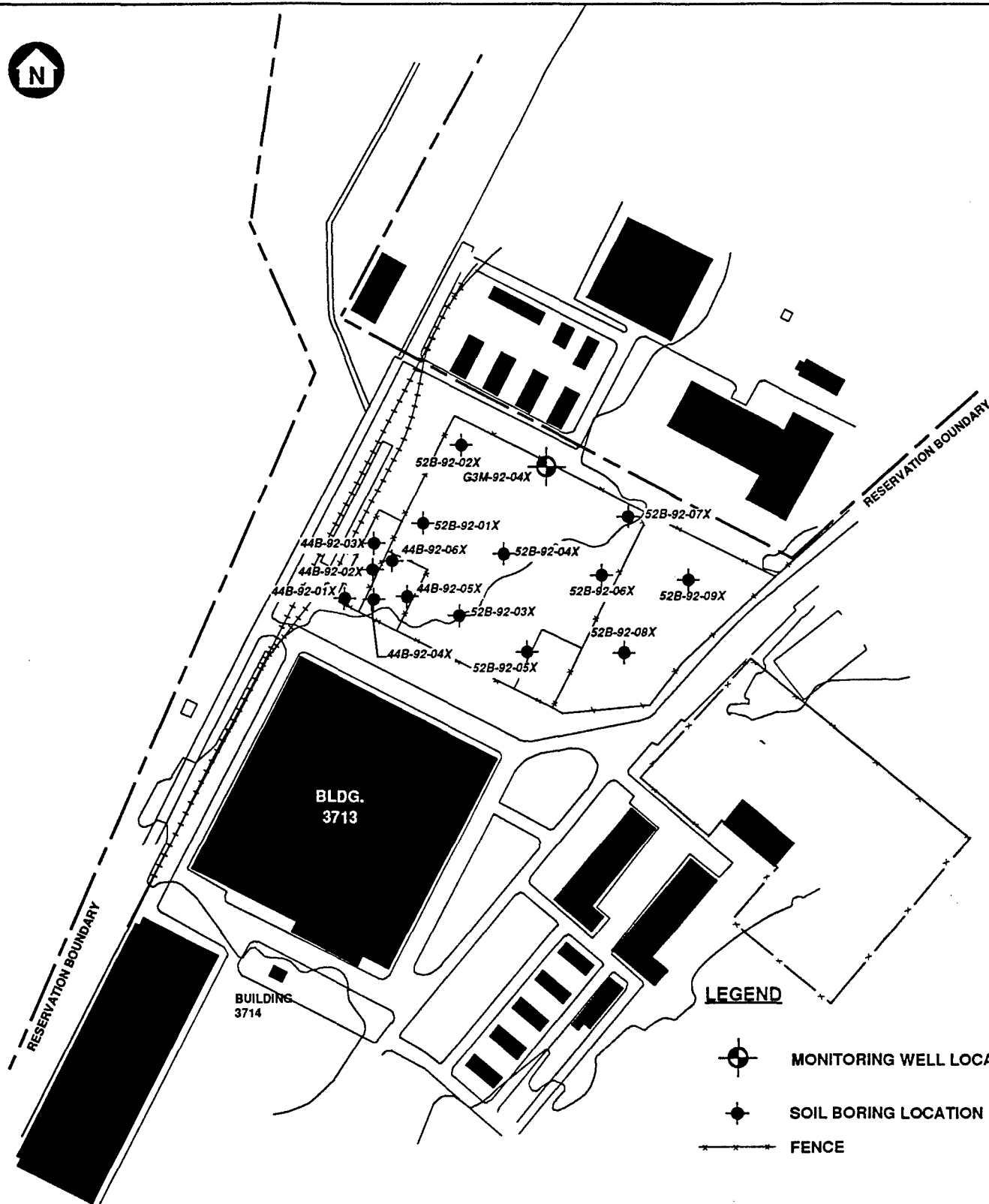


FIGURE 1-2
SOIL BORINGS AND
MONITORING WELL LOCATIONS
AOCs 44 & 52
FORT DEVENS, MA

ABB Environmental Services, Inc.

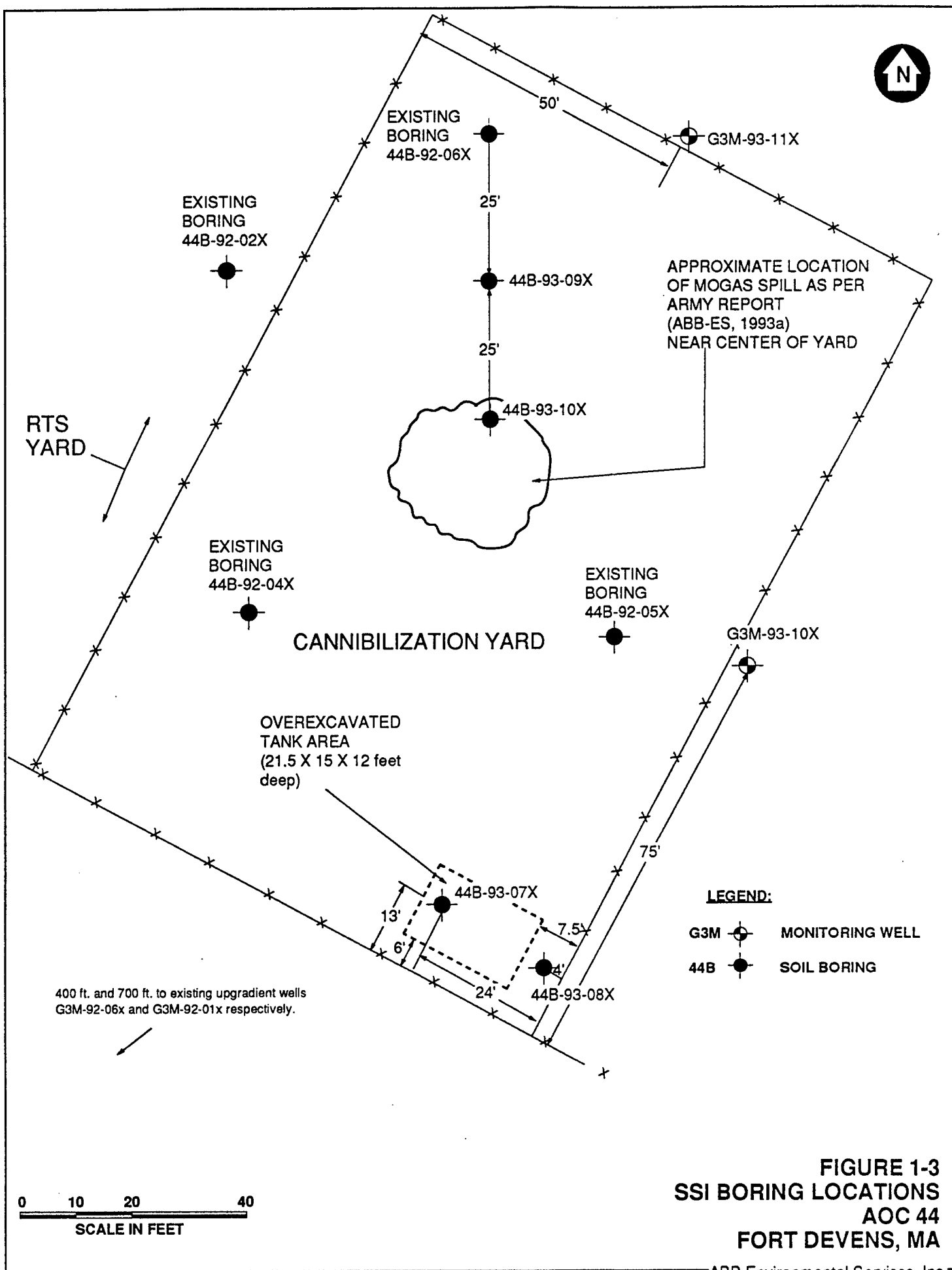


TABLE 1-1
ORGANIC COMPOUNDS IN SOIL
AOC 44 - CANNIBALIZATION YARD
EXCAVATED SOILS MANAGEMENT PLAN
FORT DEVENS

| ANALYTE | BORING | | 44B-92-01X | | | 44B-92-02X | | | 44B-92-03X | | | 44B-92-04X | | | 44B-92-05X | | | 44B-92-06X | | |
|---------------------------|--------|--|------------|---------|----------|------------|----------|----------|------------|----------|----------|------------|----------|----------|------------|----------|----------|------------|----------|----------|
| | DBPTH | | 0 | 5 | 10 | 0 | 5 | 10 | 0 | 5 | 10 | 0 | 5 | 10 | 0 | 5 | 10 | 0 | 5 | 10 |
| VOLATILES (ug/g) | | | | | | | | | | | | | | | | | | | | |
| ETHYLBENZENE | | | <0.0017 | <0.0017 | <0.0017 | <0.0017 | <0.0017 | <0.0017 | <0.0017 | <0.0017 | <0.0017 | <0.0017 | <0.0017 | <0.0017 | <0.0017 | <0.0017 | <0.0017 | <0.0017 | <0.0017 | <0.0017 |
| TOLUENE | | | <.00078 | <.00078 | <.00078 | <.00078 | <.00078 | <.00078 | <.00078 | <.00078 | <.00078 | <.00078 | <.00078 | <.00078 | <.00078 | <.00078 | <.00078 | <.00078 | <.00078 | <.00078 |
| XYLENES | | | <0.0015 | <0.0015 | <0.0015 | <0.0015 | <0.0015 | <0.0015 | <0.0015 | <0.0015 | <0.0015 | <0.0015 | <0.0015 | <0.0015 | <0.0015 | <0.0015 | <0.0015 | <0.0015 | <0.0015 | <0.0015 |
| SEMIVOLATILES (ug/g) | | | | | | | | | | | | | | | | | | | | |
| 2-METHYLNAPHTHALENE | | | <0.200 | <0.100 | <0.049 | <0.049 | <0.049 | <0.049 | <0.049 | <0.049 | <0.049 | <0.049 | <0.049 | <0.049 | <0.049 | <0.049 | <0.049 | <0.049 | <0.049 | <0.049 |
| ACENAPHTHENE | | | 0.400 | <0.070 | <0.036 | <0.036 | <0.036 | <0.036 | <0.036 | <0.036 | <0.036 | <0.036 | <0.036 | <0.036 | <0.036 | <0.036 | <0.036 | <0.036 | <0.036 | <0.036 |
| ACENAPHTHYLENE | | | 4.00 | 0.300 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 |
| ANTHRACENE | | | 5.00 | 0.700 | <0.036 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 |
| BIS(2-ETHYLHEXYL)PHTHALAT | | | <3.00 | <1.00 | <0.620 | <0.620 | <0.620 | <0.620 | <0.620 | <0.620 | <0.620 | <0.620 | <0.620 | <0.620 | <0.620 | <0.620 | <0.620 | <0.620 | <0.620 | <0.620 |
| BENZO(A)ANTHRACENE | | | 20.0 | 2.00 | <0.170 | <0.170 | <0.170 | <0.170 | <0.170 | <0.170 | <0.170 | <0.170 | <0.170 | <0.170 | <0.170 | <0.170 | <0.170 | <0.170 | <0.170 | <0.170 |
| BENZO(A)PYRENE | | | 30.0 | 2.00 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 |
| BENZO(B)FLUORANTHENE | | | 20.0 | 3.00 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 |
| BENZO(G,H)PERYLENE | | | 20.0 | 3.00 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 | <0.250 |
| BENZO(K)FLUORANTHENE | | | 20.0 | 2.00 | 0.110 | <0.066 | <0.066 | <0.066 | <0.066 | <0.066 | <0.066 | <0.066 | <0.066 | <0.066 | <0.066 | <0.066 | <0.066 | <0.066 | <0.066 | <0.066 |
| CARBAZOLE | | | 2.00 | 0.500 | ND 0.033 | ND 0.033 | ND 0.033 | ND 0.033 | ND 0.033 | ND 0.033 | ND 0.033 | ND 0.033 | ND 0.033 | ND 0.033 | ND 0.033 | ND 0.033 | ND 0.033 | ND 0.033 | ND 0.033 | ND 0.033 |
| CHRYSENE | | | 20.0 | 3.00 | 0.160 | <0.120 | <0.120 | <0.120 | <0.120 | <0.120 | <0.120 | <0.120 | <0.120 | <0.120 | <0.120 | <0.120 | <0.120 | <0.120 | <0.120 | <0.120 |
| DIBENZO(A,H)ANTHRACENE | | | 5.00 | 0.900 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 | <0.210 |
| DIBENZOFURAN | | | 0.400 | 0.200 | <0.035 | <0.035 | <0.035 | <0.035 | <0.035 | <0.035 | <0.035 | <0.035 | <0.035 | <0.035 | <0.035 | <0.035 | <0.035 | <0.035 | <0.035 | <0.035 |
| FLUORANTHENE | | | 50.0 | 7.00 | 0.250 | 0.085 | 0.088 | <0.068 | 0.280 | <0.068 | <0.068 | 0.100 | <0.068 | <0.068 | <0.068 | <0.068 | <0.068 | <0.068 | <0.068 | <0.068 |
| FLUORENE | | | 1.00 | 0.300 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 |
| INDENO(1,2,3-C,D)PYRENE | | | 20.0 | 3.00 | <0.290 | <0.290 | <0.290 | <0.290 | <0.290 | <0.290 | <0.290 | <0.290 | <0.290 | <0.290 | <0.290 | <0.290 | <0.290 | <0.290 | <0.290 | <0.290 |
| NAPHTHALENE | | | 0.600 | <0.070 | <0.037 | <0.037 | <0.037 | <0.037 | <0.037 | <0.037 | <0.037 | <0.037 | <0.037 | <0.037 | <0.037 | <0.037 | <0.037 | <0.037 | <0.037 | <0.037 |
| PHENANTHRENE | | | 20.0 | 3.00 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 |
| PYRINI | | | 20.0 | 3.00 | 0.190 | 0.049 | 0.089 | <0.033 | 0.220 | <0.033 | <0.033 | 7.00 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 | <0.033 |
| OTHER (ug/g) | | | | | | | | | | | | | | | | | | | | |
| TRICHLOROFLUOROMETHANE | | | <0.0059 | <0.0059 | <0.0059 | <0.0059 | <0.0059 | <0.0059 | <0.0059 | <0.0059 | <0.0059 | <0.0059 | <0.0059 | <0.0059 | <0.0059 | <0.0059 | <0.0059 | <0.0059 | <0.0059 | <0.0059 |
| TPHC | | | 714 | 76.2 | <27.9 | <27.9 | <27.9 | <27.9 | 34.7 | <27.7 | 40.3 | 465 | <27.7 | 33.8 | <27.7 | <28.1 | <27.7 | 8570 | 7680 | 7310 |

NOTES: TABLE LISTS DETECTED ANALYTES ONLY - SEE PROJECT ANALYTE LIST IN SI REPORT FOR SUMMARY
ND = NOT DETECTED

TABLE 1-2
ORGANIC COMPOUNDS IN SOIL
AOC 52 - TDA MAINTENANCE YARD
EXCAVATED SOILS MANAGEMENT PLAN
FORT DEVENS

| ANALYTE | BORING | 52B-92-01X | | | 52B-92-02X | | | 52B-92-03X | | | 52B-92-04X | | | 52B-92-05X | | | |
|----------------------------|--------|------------|-----------|-----------|------------|-----------|-----------|------------|-----------|-----------|------------|-----------|-----------|------------|-----------|-----------|-----------|
| | DEPTH | 0 | 5 | 10 | 0 | 5 | 10 | 0 | 5 | 10 | 0 | 0D | 5 | 10 | 0 | 5 | 10 |
| VOLATILES (ug/g) | | | | | | | | | | | | | | | | | |
| ETHYLBENZENE | | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 |
| TOLUENE | | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 |
| XYLENES | | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 |
| SEMIVOLATILES (ug/g) | | | | | | | | | | | | | | | | | |
| ACENAPHTHENE | | <0.900 | < 0.036 | < 0.036 | < 0.900 | < 0.900 | < 0.180 | 0.315 | < 0.200 | < 0.036 | < 0.072 | < 0.900 | < 0.036 | < 0.036 | < 0.070 | < 0.072 | < 0.072 |
| ACENAPHTHYLENE | | <0.825 | < 0.033 | < 0.033 | < 0.825 | < 0.825 | < 0.165 | 1.18 | < 0.200 | < 0.033 | 0.193 | < 0.825 | < 0.033 | < 0.033 | 0.500 | 0.142 | 0.090 |
| ANTHRACENE | | <0.825 | < 0.033 | < 0.033 | < 0.825 | < 0.825 | < 0.165 | 2.99 | < 0.200 | < 0.033 | 0.171 | < 0.825 | < 0.033 | < 0.033 | 0.500 | 0.143 | 0.100 |
| BIS(2-ETHYLHEXYL)PHTHALATE | | <15.5 | < 0.620 | < 0.620 | < 15.5 | < 15.5 | < 3.10 | < 3.10 | < 3.00 | < 0.620 | < 1.24 | < 15.5 | < 0.620 | < 0.620 | < 1.00 | < 1.24 | < 1.24 |
| BENZO[A]ANTHRACENE | | <4.25 | < 0.170 | < 0.170 | < 4.25 | < 4.25 | < 0.800 | 10.0 | < 0.800 | < 0.170 | 0.803 | < 4.25 | < 0.170 | < 0.170 | 1.00 | 0.392 | < 0.340 |
| BENZO[A]PYRENE | | < 6.25 | < 0.250 | < 0.250 | < 6.25 | < 6.25 | < 1.25 | 12.4 | < 1.00 | < 0.250 | 1.01 | < 6.25 | < 0.250 | < 0.250 | 2.00 | 0.743 | < 0.500 |
| BENZO[B]FLUORANTHENE | | < 5.25 | < 0.210 | < 0.210 | < 5.25 | < 5.25 | < 1.05 | 13.3 | < 1.00 | < 0.210 | 1.63 | < 5.25 | < 0.210 | < 0.210 | 3.00 | 1.06 | 0.527 |
| BENZO[G,H]PERYLENE | | < 6.25 | < 0.250 | < 0.250 | < 6.25 | < 6.25 | < 1.25 | 10.2 | < 1.00 | < 0.250 | 1.04 | < 6.25 | < 0.250 | < 0.250 | 1.00 | 0.611 | < 0.500 |
| BENZO[K]FLUORANTHENE | | < 1.65 | 0.085 | < 0.066 | < 1.65 | < 1.65 | < 0.330 | 6.48 | 0.500 | < 0.066 | 0.883 | < 1.65 | < 0.066 | 0.087 | 1.00 | 0.647 | 0.430 |
| CARBAZOLE | | ND 0.825 | ND 0.033 | ND 0.033 | ND 0.825 | ND 0.825 | ND 0.165 | 2.00 | ND 0.200 | ND 0.033 | 0.106 | ND 0.825 | ND 0.033 | ND 0.033 | 0.500 | 0.104 | ND 0.066 |
| CHRYSENE | | < 3.00 | 0.191 | < 0.120 | < 3.00 | < 3.00 | < 0.600 | 10.0 | < 0.600 | < 0.120 | 1.04 | < 3.00 | < 0.120 | < 0.120 | 2.00 | 0.764 | 0.507 |
| DIBENZO[A,H]ANTHRACENE | | < 5.25 | < 0.210 | < 0.210 | < 5.25 | < 5.25 | < 1.05 | < 1.00 | < 1.00 | < 0.210 | < 0.420 | < 5.25 | < 0.210 | < 0.210 | 0.600 | < 0.420 | < 0.420 |
| DIBENZOFURAN | | < 0.875 | < 0.035 | < 0.035 | < 0.875 | < 0.875 | < 0.175 | 0.600 | < 0.200 | < 0.035 | < 0.070 | < 0.875 | < 0.035 | < 0.035 | < 0.070 | < 0.070 | < 0.070 |
| FLUORANTHENE | | < 1.70 | 0.288 | < 0.068 | < 1.70 | < 1.70 | < 0.340 | 20.0 | 1.00 | 0.200 | 2.22 | < 1.70 | < 0.068 | 0.230 | 4.85 | 1.69 | 1.20 |
| FLUORENE | | < 0.825 | < 0.033 | < 0.033 | < 0.825 | < 0.825 | < 0.165 | 1.00 | < 0.200 | < 0.033 | < 0.066 | < 0.825 | < 0.033 | < 0.033 | 0.100 | < 0.066 | < 0.066 |
| INDENO[1,2,3-CD]PYRENE | | < 7.25 | < 0.290 | < 0.290 | < 7.25 | < 7.25 | < 1.45 | 11.0 | < 1.00 | < 0.290 | 1.57 | < 7.25 | < 0.290 | < 0.290 | 2.21 | 0.658 | < 0.580 |
| NAPHTHALENE | | < 0.900 | < 0.037 | < 0.037 | < 0.900 | < 0.900 | < 0.185 | 0.243 | < 0.200 | < 0.037 | < 0.074 | < 0.900 | < 0.037 | < 0.037 | < 0.074 | < 0.074 | < 0.074 |
| PHENANTHRENE | | < 0.825 | 0.092 | < 0.033 | < 0.825 | < 0.825 | < 0.165 | 20.0 | 0.500 | 0.074 | 0.659 | < 0.825 | < 0.033 | 0.076 | 1.51 | 0.429 | 0.400 |
| PYRENE | | 2.18 | 0.282 | < 0.033 | < 0.825 | < 0.825 | < 0.165 | 20.0 | 1.00 | 0.109 | 1.51 | < 0.825 | < 0.033 | 0.150 | 2.48 | 1.00 | 0.700 |
| OTHER (ug/g) | | | | | | | | | | | | | | | | | |
| TOTAL ORGANIC CARBON | | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| TPHC | | 142 | 65.1 | 51.5 | 304 | 129 | 60.8 | 98.0 | 30.2 | 29.8 | 79.8 | 80.4 | 39.9 | <27.7 | 647 | 170 | 119 |

NOTES: TABLE LISTS DETECTED ANALYTES ONLY - SEE PROJECT ANALYTE LIST IN SI REPORT FOR SUMMARY
ND = NOT DETECTED
NA = NOT ANALYZED

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TABLE 1-2 (continued)
ORGANIC COMPOUNDS IN SOIL
AOC 52 - TDA MAINTENANCE YARD
EXCAVATED SOILS MANAGEMENT PLAN
FORT DEVENS

| ANALYTE | | BORING | | 52B-92-06X | | | 52B-92-07X | | | 52B-92-08X | | | 52B-92-09X | | | G3M-92-04X | | |
|----------------------------|--|--------|--|------------|-----------|-----------|------------|-----------|-----------|------------|-----------|-----------|------------|-----------|-----------|------------|-----------|-----------|
| | | DEPTH | | 0 | 5 | 10 | 0 | 5 | 10 | 0 | 5 | 10 | 0 | 5 | 10 | 0 | 12 | 26 |
| VOLATILES (ug/g) | | | | | | | | | | | | | | | | | | |
| ETHYLBENZENE | | | | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | < 0.00170 | 0.0049 | < 0.00170 | < 0.00170 |
| TOLUENE | | | | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | < 0.00078 | 0.0023 | < 0.00078 | < 0.00078 |
| XYLENES | | | | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | < 0.00150 | 0.0220 | < 0.00150 | < 0.00150 |
| SEMIVOLATILES (ug/g) | | | | | | | | | | | | | | | | | | |
| ACENAPHTHENE | | | | < 0.072 | < 0.072 | < 0.180 | < 0.036 | < 0.036 | < 0.070 | < 0.072 | < 0.180 | < 0.180 | < 0.072 | < 0.036 | < 0.036 | < 0.900 | < 0.036 | < 0.036 |
| ACENAPHTHYLENE | | | | 0.168 | < 0.066 | < 0.165 | < 0.033 | 0.144 | < 0.070 | < 0.066 | < 0.825 | < 0.165 | < 0.165 | 0.469 | < 0.033 | < 0.033 | < 0.825 | < 0.033 |
| ANTHRACENE | | | | 0.122 | 0.143 | < 0.165 | < 0.033 | 0.121 | < 0.070 | < 0.066 | < 0.825 | < 0.165 | < 0.165 | 0.475 | < 0.033 | < 0.033 | < 0.825 | < 0.033 |
| BIS(2-ETHYLHEXYL)PHTHALATE | | | | < 1.24 | < 1.24 | < 3.10 | < 0.620 | < 0.620 | < 1.00 | < 1.24 | < 15.5 | < 3.10 | < 3.10 | < 1.24 | 0.974 | < 0.620 | < 15.5 | < 0.620 |
| BENZO(A)ANTHRACENE | | | | 0.399 | 0.391 | < 0.800 | < 0.170 | 0.239 | < 0.300 | < 0.340 | < 4.25 | < 0.800 | < 0.800 | 0.780 | < 0.170 | < 0.170 | 4.95 | < 0.170 |
| BENZO(A)PYRENE | | | | < 0.500 | < 0.500 | < 1.25 | < 0.250 | 0.376 | < 0.500 | < 0.500 | < 6.25 | < 1.25 | < 1.25 | 1.00 | < 0.250 | < 0.250 | < 6.25 | < 0.250 |
| BENZO(B)FLUORANTHENE | | | | 1.08 | < 0.420 | < 1.05 | < 0.210 | 0.980 | 0.800 | < 0.420 | < 5.25 | 2.04 | < 1.05 | 1.32 | < 0.210 | < 0.210 | 10.0 | < 0.210 |
| BENZO(G,H)PYRENE | | | | 0.622 | < 0.500 | < 1.25 | < 0.250 | 0.682 | < 0.500 | < 0.500 | < 6.25 | < 1.25 | < 1.25 | 1.01 | < 0.250 | < 0.250 | < 6.25 | < 0.250 |
| BENZO(K)FLUORANTHENE | | | | 0.439 | 0.430 | < 0.330 | < 0.066 | 0.339 | 0.200 | < 0.132 | < 1.65 | 0.499 | < 0.330 | 0.643 | 0.076 | < 0.066 | 2.18 | < 0.066 |
| CARBAZOLE | | | | ND 0.066 | ND 0.066 | ND 0.165 | ND 0.033 | 0.063 | ND 0.070 | ND 0.066 | ND 0.825 | ND 0.165 | ND 0.165 | 0.083 | ND 0.033 | ND 0.033 | ND 0.825 | ND 0.033 |
| CHRYSENE | | | | 0.777 | 0.761 | < 0.600 | < 0.120 | 0.581 | 0.500 | < 0.240 | 3.41 | 1.31 | 1.29 | 1.52 | < 0.120 | < 0.120 | 10.0 | < 0.120 |
| DIBENZO(A,H)ANTHRACENE | | | | < 0.420 | < 0.420 | < 1.05 | < 0.210 | < 0.210 | < 0.420 | < 0.420 | < 5.25 | < 1.05 | < 1.05 | < 0.420 | < 0.210 | < 0.210 | < 5.25 | < 0.210 |
| DIBENZOFURAN | | | | < 0.070 | < 0.070 | < 0.175 | < 0.035 | < 0.035 | < 0.070 | < 0.070 | < 0.875 | < 0.175 | < 0.175 | < 0.070 | < 0.035 | < 0.035 | < 0.875 | < 0.035 |
| FLUORANTHENE | | | | 1.71 | 1.92 | < 0.340 | < 0.068 | 0.965 | 0.720 | 0.217 | 6.45 | 2.48 | 1.22 | 2.39 | 0.109 | < 0.068 | 15.2 | < 0.068 |
| FLUORENE | | | | < 0.066 | < 0.066 | < 0.165 | < 0.033 | < 0.033 | < 0.066 | < 0.066 | < 0.825 | < 0.165 | < 0.165 | 0.169 | < 0.033 | < 0.033 | < 0.825 | < 0.033 |
| INDENO(1,2,3-C)DIPYRENE | | | | 0.669 | < 0.580 | < 1.45 | < 0.290 | 0.911 | < 0.580 | < 0.580 | < 7.25 | < 1.45 | < 1.45 | 1.31 | < 0.290 | < 0.290 | < 7.25 | < 0.290 |
| NAPHTHALENE | | | | < 0.074 | < 0.074 | < 0.185 | < 0.037 | < 0.037 | < 0.070 | < 0.074 | < 0.900 | < 0.185 | < 0.185 | < 0.074 | < 0.037 | < 0.037 | < 0.900 | < 0.037 |
| PHENANTHRENE | | | | 0.400 | 1.28 | < 0.165 | < 0.033 | 0.228 | 0.200 | < 0.066 | 2.87 | 1.10 | 0.545 | 1.49 | < 0.033 | < 0.033 | 10.8 | < 0.033 |
| PYRENE | | | | 1.00 | 1.00 | < 0.165 | 0.049 | 0.736 | 0.500 | 0.148 | 6.59 | 2.53 | 1.87 | 2.20 | 0.086 | < 0.033 | 21.7 | < 0.033 |
| OTHER (ug/g) | | | | | | | | | | | | | | | | | | |
| TOTAL ORGANIC CARBON | | | | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 283 |
| TPHC | | | | 131 | 58.3 | 48.5 | 39.1 | 89.1 | 97.5 | 30.2 | 73.1 | 34.5 | < 28.1 | 33.4 | 33.7 | 33.4 | 716 | 51.5 |

NOTES: TABLE LISTS DETECTED ANALYTES ONLY - SEE PROJECT ANALYTE LIST IN SI REPORT FOR SUMMARY
ND = NOT DETECTED
NA = NOT ANALYZED

TABLE 1-3
ORGANIC COMPOUNDS IN SOIL
SSI SOIL BORINGS
AOC 44 - CANNIBALIZATION YARD
EXCAVATED SOILS MANAGEMENT PLAN
FORT DEVENS

| ANALYTE (ug/g) | BACK - GROUND | | 44B-93-07X | | | 44B-93-08X | | | 44B-93-09X | | | 44B-93-10X | | | | | | |
|---------------------|------------------|-----------------|----------------------|----|----|--------------------------|----|----|----------------------------------|---|----|-----------------------------|----|----|----------------------|----|----|----|
| | | BORING DEPTH | 15 | 21 | 24 | 5 | 10 | 15 | 25 | 5 | 5D | 10 | 15 | 25 | 5 | 10 | 15 | 25 |
| ORGANICS | | | | | | | | | | | | | | | | | | |
| BIS(2-E-H)PHTHALATE | | | < 0.62 < 0.62 < 0.62 | | | < 0.62 < 0.62 < 0.62 | | | < 0.62 < 0.62 < 0.62 | | | < 0.62 < 0.62 < 0.62 | | | < 0.62 < 0.62 < 0.62 | | | |
| FLUORANTHENE | | | < 0.07 < 0.07 < 0.07 | | | < 0.07 < 0.07 < 0.07 | | | < 0.07 < 0.07 < 0.07 | | | < 0.07 < 0.07 < 0.07 | | | < 0.07 < 0.07 < 0.07 | | | |
| PHENANTHRENE | | | < 0.03 < 0.03 < 0.03 | | | < 0.03 < 0.03 < 0.03 | | | < 0.03 < 0.03 < 0.03 | | | < 0.03 < 0.03 < 0.03 | | | < 0.03 < 0.03 < 0.03 | | | |
| PYRENE | | | < 0.03 < 0.03 < 0.03 | | | < 0.03 < 0.03 < 0.03 | | | < 0.03 < 0.03 < 0.03 | | | < 0.03 < 0.03 < 0.03 | | | < 0.03 < 0.03 < 0.03 | | | |
| TPHC | | | < 30 < 29.7 < 29.8 | | | < 31.2 121 < 29.5 < 34.4 | | | < 29.6 38.1 < 29.6 < 29.5 < 33.1 | | | < 29.4 < 29.6 < 29.6 < 35.1 | | | | | | |

NOTES: TABLE LISTS DETECTED ANALYTES ONLY - SEE PROJECT ANALYTE LIST IN SI REPORT (ABB-ES, 1993)
NA = NOT ANALYZED

Table 3-1
Soil Sampling and Analysis
Excavated Soils Management Plan
AOCs 44 and 52 - Fort Devens

| Work Action | Sample Frequency | Analytes | Estimated No. of Samples | Analysis Method |
|--|---|---------------------------|--------------------------|---|
| Trench exploration around 44B-93-10X (field lab) | Every 10 feet horizontally for a distance of 40 feet west, south and east and 10 feet north of 44B-93-10X. Sample at 2 to 3 feet below grade. | TPHC | 13 or as required | Modified EPA Method 418.1 Non-dispersive Infrared (NDIR) |
| Defining excavation extent in hot spot areas (field lab) | As required from sides and bottom of excavation until concentration is below screening level. | TPHC | As required. | Modified EPA Method 418.1 (NDIR) |
| Confirming cleanup of hot spot areas (off-site lab) | 2 grab sample along each side wall and 2 grab samples from bottom (10 total for each excavation). | TPHC | 30 | EPA Method 418.1 |
| Soil stockpiles - Surface Soils (field lab) | 1 composite sample/100 cy. | TPHC PAHs ¹ | 290 290 | Modified EPA Method 418.1 (NDIR) Modified Method 8270 |
| Soil stockpiles - Hot Spot Areas (field lab) | 1 composite sample/100 cy. | TPHC | 7 or as required | Modified EPA Method 418.1 (NDIR) |

NOTES:

¹ Analysis for:

Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Chrysene
Dibenzo(a,h)anthracene
Indeno(1,2,3-cd)pyrene